

Pilot Balloon Observations, 2013

Jefferson County Smoke Management

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Abstract

Pilot Balloon (Pibal) observations are a major component of the daily decision-making process used in managing open field burning of grass seed and wheat fields in Jefferson County. Pibals are used to track upper level wind direction and speed. Pibals are released daily from the Central Oregon Agricultural Research Center (COARC) between 10:30 am and 3:30 pm. Pibal releases at potential burn sites allow for more accurate decision-making under marginal conditions. The Pibal is essential in minimizing adverse smoke impacts on local communities.

Introduction

The Pibal program began in 1998, and incorporates the weather balloon data into information the Jefferson County Smoke Management Coordinator receives from the Oregon Department of Agriculture (ODA) Weather Center. Pibal data compiled with Real-Time Weather Data, courtesy of the US Bureau of Reclamation AgriMet Network, can be found on the Jefferson County Smoke Management website. The objective is to provide real time wind patterns, wind speed and wind direction information for the Smoke Management Coordinator to determine whether burning will be allowed.

Materials and Methods

During the field-burning season from July 29 to September 27, 2013, daily balloon releases occurred on demand throughout the day. The release times and locations were requested daily by the Smoke Management Coordinator. Air temperature, relative humidity, and surface wind direction and speed are documented at the time of the Pibal releases using the AgriMet weather station at the Central Oregon Agricultural Research Center. Wind directions and speeds are determined at one-minute intervals for a period of ten minutes using an observation Theodolite System and a twenty-six inch diameter helium filled balloon (Pibal). The Pibal is used to verify the forecast for the upper level wind direction, speed and mixing height. The software program, Pibal Analyzer, developed by the Oregon Department of Agriculture (ODA) analyzes Pibal information, which includes three components. The first is the Pibal Sounding, a spreadsheet translating the azimuth (azimuth are angles used to define the apparent position of an object in the sky, relative to a specific observation point) and elevation readings from the wind direction and average wind speed. The second is the Hodograph, which charts the wind direction. The Profile page, the third component, graphs the wind speed. The Pibal soundings are entered into the Pibal Analyzer and transmitted to the Jefferson County Smoke Management website for the Smoke Management Program Coordinator. The Coordinator then uses this data in conjunction with the aircraft soundings and the ODA Weather Center forecast to determine the field burning status for the day.

Results and Discussion

The open field-burning season was 61 days long, with a total of 10,903 acres burned that included 3,597 acres of grass and 7,306 acres of wheat. Daily balloon releases in the late morning and throughout the day were used to refine the weather forecast; it was a valuable tool for determining the mixing height for smoke during the optimal burn times. The pibal provided the only method to detect the stable air layers. The pibal is particularly helpful on marginal burn days to assist the Smoke Management Coordinator in making the decision whether to allow burning when conditions were either changing or hard to discern. It is on these marginal days, when the conditions are unclear, that the most risk for smoke intrusion into populated areas exists. Using the pibal at the site of the potential burn prior to making the final decision was proved to be a valuable tool again during the 2013 season.

WEATHER INFORMATION: 2013 WATER YEAR, POWELL BUTTE, OREGON (SOURCE: AGRIMET)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
AIR TEMPERATURE (°F)												
Avg. Maximum	64	52	41	43	48	55	59	69	75	87	84	73
Avg. Minimum	34	33	25	23	25	28	30	37	44	49	50	44
Mean	49	42	33	32	36	41	45	53	61	70	67	59
AIR TEMP (no. of days)												
Max. 90°F or Above	0	0	0	0	0	0	0	0	2	12	1	2
Max. 32°F or Below	0	0	0	4	7	0	0	0	0	0	0	0
Min. 32°F or Below	14	15	26	25	23	18	20	8	1	0	0	2
Min. 0°F or Below	0	0	0	0	0	0	0	0	0	0	0	0
SOIL TEMP (°F at 4 in.)												
Avg. Maximum	53	46	38	34	37	43	48	59	68	77	72	65
Avg. Minimum	51	45	37	33	36	40	45	55	64	71	68	62
SOIL TEMP (°F at 8 in.)												
Avg. Maximum	53	47	39	35	37	42	47	58	66	75	70	65
Avg. Minimum	52	46	39	34	36	41	46	58	64	72	69	64
PRECIPITATION (in.)												
Monthly Total	1.15	1.11	0.17	0.38	0.07	0.55	0.43	2.29	1.34	0.0	0.37	1.47
EVAPORATION (in.)												
Daily Avg.	0.11	0.05	0.03	0.04	0.05	0.09	0.16	0.21	0.26	0.36	0.25	0.18
WIND SPEED (mph)												
Daily Avg.	4.6	4.7	5.3	5.5	4.6	4.7	6.4	5.1	4.7	4.9	4.3	5.2
SOLAR RADIATION (langley)												
Daily Avg.	292	159	114	162	227	331	473	530	611	700	499	380
HUMIDITY (% relative humidity)												
Daily Avg.	55	73	74	64	66	63	58	57	56	35	54	60
GROWING SEASON	Last Day Before			First Day After				Total Number of Days				
	July 15			July 15				Between Temp. Mins.				
Air Temp Min.												
32°F or Below	June 14			Sept 27				105				
28°F or Below	May 25			Oct. 14				142				
24°F or Below	May 1			Oct. 29				181				

WEATHER INFORMATION: 2013 WATER YEAR, MADRAS, OREGON (SOURCE: AGRIMET)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
AIR TEMPERATURE (°F)												
Avg. Maximum	64	58	46	43	48	55	60	70	76	89	84	74
Avg. Minimum	37	32	25	21	26	30	32	40	46	51	52	47
Mean Temp.	50	42	34	30	36	42	47	55	61	71	68	60
AIR TEMP (no. of days)												
Max. 90°F or Above	0	0	0	0	0	0	0	0	2	14	2	2
Max. 32°F or Below	0	0	2	5	0	0	0	0	0	0	0	0
Min. 32°F or Below	10	19	26	26	25	18	13	2	0	0	0	0
Min. 0°F or Below	0	0	0	0	0	0	0	0	0	0	0	0
SOIL TEMP (°F at 4 in.)												
Avg. Maximum	58	47	39	34	40	47	56	66	73	79	73	65
Avg. Minimum	51	43	38	33	36	42	49	58	63	70	67	61
SOIL TEMP (°F at 8 in.)												
Avg. Maximum	57	48	40	35	39	46	53	64	70	76	72	65
Avg. Minimum	54	46	39	35	38	43	50	60	66	72	68	63
PRECIPITATION (in.)												
Monthly Total	0.67	1.63	2.20	0.3	0.0	0.54	0.26	0.89	0.73	0.0	1.43	1.29
EVAPORATION (in.)												
Daily Avg.	0.13	0.07	0.04	0.03	0.06	0.10	0.18	0.23	0.26	0.36	0.26	.20
WIND SPEED (mph)												
Daily Avg.	6.4	6.0	7.0	4.5	5.5	5.4	7.9	6.0	5.2	5.8	4.7	6.5
SOLAR RADIATION (langley)												
Daily Avg.	279	143	107	156	229	344	512	587	560	506	520	385
HUMIDITY (% relative humidity)												
Daily Avg.	56	81	78	76	70	64	58	57	58	37	56	62
GROWING SEASON	Last Day Before			First Day After				Total Number of Days				
	July 15			July 15				Between Temp. Mins.				
Air Temp Min.												
32°F or Below	May 25			Oct. 2				130				
28°F or Below	May 1			Oct. 14				166				
24°F or Below	May 1			Oct. 30				182				